Figure 1
In the future, computers will have an even more important role in all aspects of your life by providing vast information resources, fast communications, and powerful support for activities in homes, schools, and businesses.

TRENDS 2002
A Look to the Future

WEB INSTRUCTIONS: *To gain World Wide Web access to additional and up-to-date information regarding this special feature, start your browser and enter the URL shown at the top of this page.*

Progress in computing no longer affects only computer scientists, engineers, and information technologists. Today, computer advances influence all individuals, families, organizations, and schools (Figure 1). As you have learned throughout this book, computers already are an essential part of people's daily lives; they quickly have become a mainstay, much as the automobile, television, and telephone have. In the future, computers will take on many new roles and become an even more pervasive and critical part of homes, schools, and businesses. This special feature looks at several computer technology trends that will influence the direction of the computer field and then looks at the impact those technologies will have on information technology in business.

TRENDS IN COMPUTER TECHNOLOGY

During the next several years, the greatest advances in computer technology will occur in areas such as hardware, software, communications and networks, mobile and wireless connectivity, and robotics.

Hardware

Manufacturers intensely are developing and producing new devices, including microdisplays and headsets, that will pervade all aspects of people's lives. This hardware will contain faster and smaller chips, which could be implanted in your body. Atomic Quantum computers and optical computers could process data at record-breaking speeds. Fluorescent multiplayer discs and digital books will revolutionize the ways information is stored and accessed. These hardware developments will affect learning and playing.

Figure 2
IBM's custom processor built with new technology contains circuits as small as 0.13 of a micron, or nearly 800 times thinner than a human hair. The smaller circuitry and improved materials can pack more processing power on a single chip.

UBIQUITOUS COMPUTING Computers are not yet everywhere, but as they get smaller, faster, and less expensive, they are being utilized in everything from toothbrushes and curling irons to cars and spaceships. Ralph Merkle, a research scientist at Xerox's Palo Alto Research Center, envisions a "not-so-distant future, maybe by 2020, definitely by 2050, [in which] we will have devices with the computational power of . . . roughly a billion Pentium computers." Having access to such enormous computational power will change the emphasis of computing from processing data to generating information to managing knowledge. Further, every device known to man, including the human body, will use some type of computer to help it function more efficiently and effectively.

NEXT-GENERATION CHIP Engineers are using extreme ultraviolet lithography (UVL) to turn their circuit designs into silicon chips. This technology uses ultrasmooth mirrors, rather than optical projection, to draw circuits that are 100 times more powerful than today's chips. Intel's Pentium® 4 processors run at speeds of 1.4 GHz and higher and contain 42 million transistors that are 0.13 of a micron wide. A micron is the width of a human hair (Figure 2). By 2005, chip manufacturers plan to introduce chips that will run at speeds up to 10 GHz with 400 million transistors that are just 0.03 of a micron wide. When the circuits are closer together, data travels shorter distances and consequently requires less time to process. Intel's 64-bit Itanium processor also will improve the speed of high-end workstations and servers.

MICRODISPLAYS AND HEADSETS You will be seeing technology in a whole new way with the advent of visual devices that resemble sunglasses. One model replicates a 52-inch television screen or Sony PlayStation 2 on an LCD screen (Figure 3). Headsets plug into DVD players, notebook computers, desktop computers, and digital cameras and allow a display measuring one-tenth of an inch to look like a full-sized theater screen. Microdisplays the size of postage stamps fill your field of vision and appear as large as a regular monitor when magnified (Figure 4).

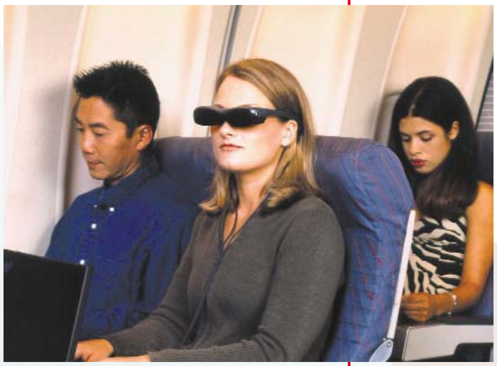


Figure 3
Video and television images will appear right before your eyes with new visual appliances.

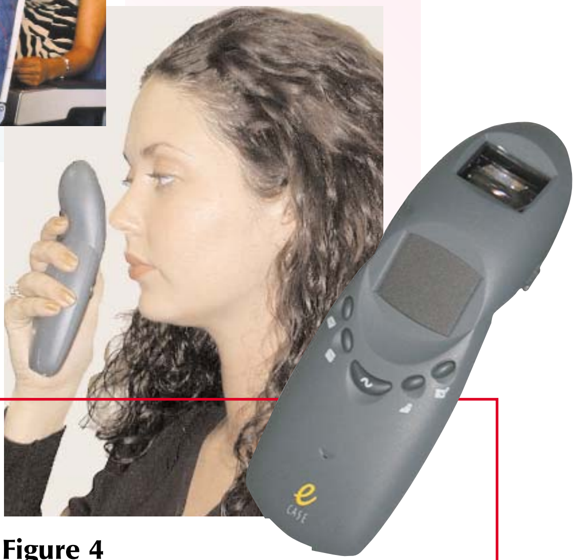


Figure 4
Microdisplays give you the visual equivalent of a 19-inch monitor and allow you to view Web pages, e-mail, maps, and calendars.

HUMAN COMPUTER INTEGRATION Some researchers believe the processor eventually will become an integral part of the most complex device known — the human body. Computers already are used inside the human body. Cochlear implants, for example, help some deaf people hear by stimulating the ear and the nerves that send information to the brain. The next step in human computer integration will involve implanting chips in the body to help it perform basic functions (Figure 5). A processor, for example, could help regulate the release of hormones in the same way that a processor regulates the fuel mixture in modern autos.

Canadian futurist Frank Ogden has conceived an even more futuristic use of embedded processors, called CyberSight. With CyberSight, a processor interfaces with a person's optic nerve to allow him or her to see information transmitted over a wireless link. The CyberSight system, for example, could transmit the floor plans of a building to a firefighter; the plans then would display in the vision of the firefighter, so that he or she can determine the best way to enter a burning building.

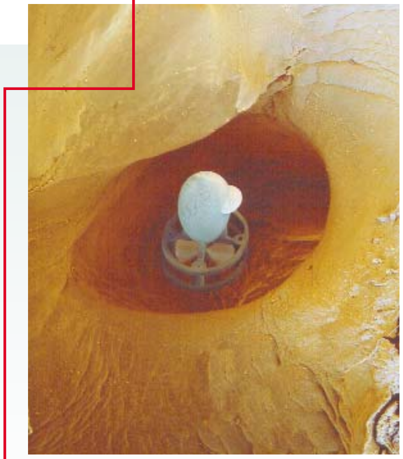


Figure 5
Doctors hope to use a microsubmarine to detect and repair defects in the human body. This device measures four millimeters in length and 0.65 millimeter in diameter.

ATOMIC QUANTUM COMPUTERS By the middle of this century, the computer on your desk could very well be filled with liquid instead of transistors and chips. It probably will be called a QC for Quantum computer, rather than a personal computer. In theory, the speed of Quantum computers could be up to a billion times faster than today's fastest Pentium® 4 computers. At that speed, a Quantum computer could search the entire Internet instantaneously or break any security code in a second. Quantum computers use quantum mechanics, rather than digital technology. In a Quantum computer, bits are replaced by atoms. Several computer companies, the federal government, and a number of independent research teams are working feverishly to put the theory of quantum computing into practice.

OPTICAL COMPUTERS Transmitting data using optical technology has become commonplace in CD-ROM drives, laser printers, photocopiers, and scanners and in fiber optic digital communications. Some engineers believe this technology will extend to computers using visible light or infrared beams to perform digital computations, increasing the speed of operations tenfold. Likewise, it should decrease the optical computers' physical size because the light beams can pass through each other without interacting.

FLUORESCENT MULTILAYER DISC (FMD) The next step in storage capacity is the Fluorescent Multilayer Disc. The first generation of this five-inch clear optical medium can hold 140 GB of data — almost 30 times more than a DVD-ROM disc can store. Data is recorded on fluorescent materials, which reflect light, on the disc's multiple layers. These discs could have as many as 100 layers of data, which will increase their storage capacity to one terabyte (one trillion bytes). Uses include high-definition television, digital cinema, and mobile applications, such as digital cameras. FMD-ROM drives currently are read-only, but engineers are perfecting recordable FMD technology.

Figure 6
Demand is expected to increase for electronic books (e-books). Some of these devices can hold up to 56,000 pages, or the equivalent of 150 books' worth of text.

DIGITAL BOOKS The Internet clearly will have a major impact on libraries. During this decade, many libraries will convert hard copy documents into digital form. Eventually, this could develop into online universal libraries to which all schools have access. While looking for a book in this online universal library, you could search a network of individual online libraries to find the book, view any checkout terms or fees, and then view or download it from the library Web site. Traditional libraries, however, still will exist, if only to house publicly accessible computers and a collection of books required to verify digitized versions.

Initial consumer reluctance for the electronic book, or e-book, is expected to subside in the next few years. Several companies have introduced these small book-sized computers (Figure 6) that can hold up to 56,000 pages, or about 150 books' worth of text. By pressing a button, you can move forward or backward through the text. You also can download Web pages and add notes or highlight text using a small pen input device. Although the tablet-sized displays will not have the clear resolution of ink on a page for years to come, Microsoft has developed ClearType, which significantly enhances the appearance of the font on a screen.

EDUCATION The use of personal computers in educational settings is another rapidly growing area. The Internet and the World Wide Web are affecting education, as distance education allows students to take classes or Webinars — online seminars — whenever they have time from home or workplace computers. Such courses are ideal for workers seeking advanced training but lacking the time to pursue on-campus studies or for undergraduates living far from campus. University professors will continue to develop entire courses using video lectures with coordinated demonstrations on virtual blackboards — all distributed to students over the Internet. Critics argue, however, that while the Internet can help with continuing education and professional retraining initiatives, a fully Internet-based education cannot capture the full value of the educational experience.

Imagine learning a new subject without ever going to class or opening a book. A further phase of human computer integration could involve making various disciplines such as mathematics, literature, and foreign languages available on processors. If you wanted to learn Dutch, you could purchase a chip from a local retail store, much as you purchase a CD. Once you upload the chip to your brain through an implanted port, immediately you will know Dutch — without ever taking a class. While this may seem farfetched, recent advances suggest it is possible.

ENTERTAINMENT For the younger members of the family, playing games using entertainment software always has had a large appeal. Many adults, however, find that entertainment software also provides them with hours of enjoyment. Popular types of entertainment software include arcade games, board games, and simulations.

Entertainment software also consists of a variety of interactive adventure games, which range from rescuing a princess from a castle's dungeon to solving a murder mystery. You can play many of these games in groups using a network or on the World Wide Web, or you can play with just the computer as your opponent. Entertainment software usually allows players to adjust the level of play to match their abilities — that is, beginner through advanced. With entertainment software, the computer becomes a fun, skillful, and challenging game partner.

Sega Corporation is developing an assortment of games to play on Motorola's new application-upgradable handsets. UIEvolution is working on interactive games, starting with chess, checkers, hangman, and Space Invaders, that allow users to play between multiple wireless handsets.

Virtual reality (VR) is the use of computers to simulate a real or imagined environment that appears as a three-dimensional (3-D) space. VR allows you to explore and manipulate controls to experience the 3-D space completely (Figure 7). One futurist suggests that VR someday will allow moviegoers to pretend they are one of the movie characters. In such an environment, the virtual reality technology would link the moviegoer's sensory system (sight, smell, hearing, taste, and touch) to the character's sensory system.

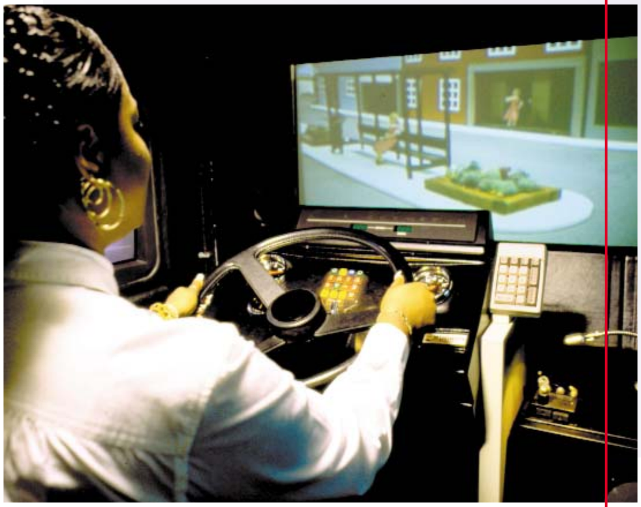


Figure 7
New Jersey bus driver trainees learn to maneuver their vehicles on virtual streets. New Jersey Transit says the virtual training saves the company thousands of dollars each year in training costs and also reduces accidents.

Software

A second major area of technology innovation involves the instructions that tell computers what tasks to perform. Software trends include improved user interfaces, enhanced Internet content, digital music, MP4 video compression, intelligent agents, speech recognition, and remote control of home appliances.

USER INTERFACE Most computers use a graphical user interface (GUI), which developers have dubbed the WIMP (windows, icons, menus, and pointer) interface. To use the WIMP interface, you must learn a new mode of communication that includes pointing, clicking, dragging, and so on. Next-generation operating systems will be more natural and human-centric, meaning they will allow you to interface with a computer using many of the methods you now use to communicate with humans. Such methods will include natural language, hand gestures, facial expressions, and of course, spoken words.

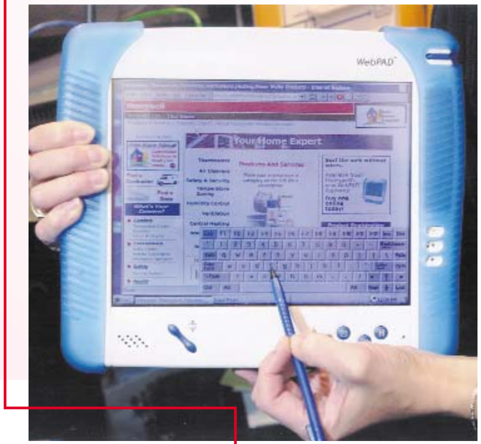


Figure 8
Web tablets offer consumers easy access to browsers and Web sites.

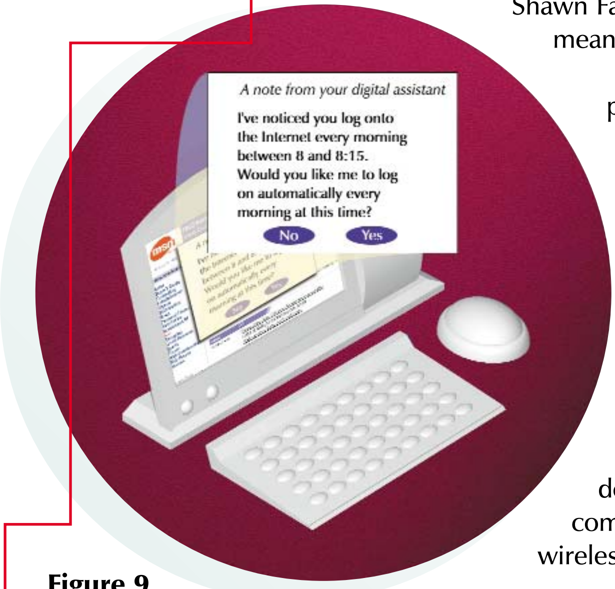
THE INTERNET AND THE WEB In this decade, the Internet and the Web promise many exciting developments. Already, the Internet is the fastest growing segment of the computer industry and is a major reason why consumers are buying personal computers and handheld devices at a record pace. Today, one half of U.S. homes have access to the Internet. At present, individuals primarily use the Internet to access information and communicate using e-mail. In the future, individuals increasingly will rely on two other Internet-based communication applications — telephony and videoconferencing.

Other developments will be Web tablets (Figure 8), which feature full-color touch screens allowing users easy access to the Internet, and the continued integration of television, networks, and computers. For now, the relatively inexpensive WebTV allows you to send e-mail and surf the Web using your television set. In the future, you will use WebTV in an interactive fashion to view your favorite movie, television show, concert, sporting event, or shopping guide.

MUSIC AND THE INTERNET As more digital music becomes available for download from the Internet, market analysts predict fewer consumers will buy CDs and will instead turn to MP3 and other digital audio players. MP3 technology compresses audio files, so music can be downloaded from Web pages and transmitted in e-mail messages much faster than with uncompressed files. Sales of players using this technology have soared from $126 million in 1999 to an expected $1.25 billion by the end of 2002. This growth is due, in part, to Shawn Fanning and his Napster software and company, which were created as a means of allowing music lovers to swap songs.

Legal proceedings for copyright infringement against Napster and its progeny helped spur consumer awareness that high-quality music is available on the Internet, and many musicians have released songs solely on the Web. Sony and many other entertainment companies are pursuing selling music via Internet-based pay-per-listen systems. Some analysts predict one-third of all consumers will have virtual music collections by 2005.

MP4 VIDEO COMPRESSION Video files can be compressed to 10 percent of their original size with MP4 technology, which filters out images the eye cannot perceive. Using today's standards, a full-length compressed video would take two hours to download, but as broadband Internet access and data transfer rates increase, the download time should become more manageable. Entertainment companies are considering sending movie trailers and video messages on wireless handheld devices.



A note from your digital assistant

I've noticed you log onto the Internet every morning between 8 and 8:15. Would you like me to log on automatically every morning at this time?

Figure 9
Intelligent agents are programs with built-in intelligence that monitors a user's work patterns and carry out tasks independently.

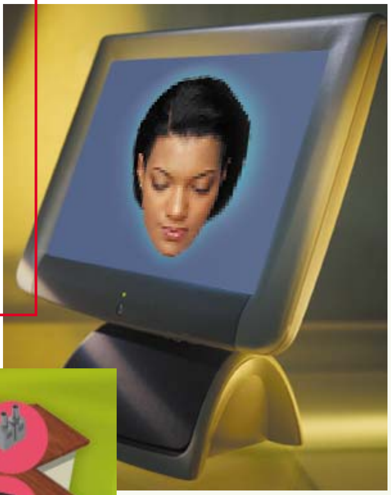
INTELLIGENT AGENTS For more than 40 years, artificial intelligence (AI) experts promoted the advantages of smart software — that is, software with built-in intelligence. In recent years, as this concept has become reality, the term, intelligent agent, has evolved to describe any software program that independently asks questions, pays attention to work patterns, and carries out tasks on behalf of a user (Figure 9).

Some intelligent agents are embedded and work within a single program. Other intelligent agents, sometimes called network agents, perform tasks on multiple remote computers with different platforms before bringing the results back to the user. Intelligent agents already are a part of several productivity software packages. Some e-mail software, for example, includes intelligent agents that allow individuals and businesses to filter incoming messages and request immediate notification of messages about specific subjects or from specific individuals. The Intellisense™ technology built into Microsoft Office also is based on an intelligent agent.

SPEECH RECOGNITION The ability to understand a natural language means that a computer will be capable of translating your spoken statements into computer instructions and responding in an appropriate fashion. The market for voice recognition software is expected to climb to $22.6 billion in 2003, up from $356 million in 1997. The newest version of Microsoft Office includes Office Speech Recognition software, which allows you to speak the names of menu commands, toolbar buttons, dialog box controls, text, and numbers. You also can instruct the computer to read a document or worksheet to you in a male or female voice. In the near future, computers will support continuous-speech voice recognition and use artificial intelligence to determine the meaning of your spoken words.

In an even more advanced use of speech recognition, computers will recognize your voice commands and respond in a computer-generated voice through an on-screen presence that resembles a person, animal, or other object. IBM and Apple, for example, have developed prototype interfaces that resemble the human head (Figure 10). When using this interface, you turn off the computer by telling the character to go to sleep. The character closes its eyes and droops its head as the computer begins to shut down.

Figure 10
Companies have prototype interfaces that resemble the human head to make voice recognition more realistic.



CONTROL OF HOME SYSTEMS The smart home of the future will include appliances that plug into the Internet (Figure 11). Electronics retailers will feature integrated systems to network your computer, television, security system, heating and air conditioning units, stove, refrigerator, DVD, VCR, video games, and monitoring devices. You then will be able to use a telephone or computer to change the operation of one of the control systems, such as turning lights on or off or viewing the contents of your storeroom by using a Web cam.

Smart appliances using the Sun Microsystems Java and Jini technologies can perform time-consuming chores. For example, your refrigerator or pantry will be linked through a home control system to the grocery store and order groceries without your intervention. Modern refrigerators will have Web panels that display recipes and then convert the recipes' ingredients to shopping lists, which can be forwarded to a handheld computer, mobile telephone, or online shopping service, such as Webvan (Figure 12). Dishwashers will communicate with their manufacturers to report malfunctions or maintenance problems and then be repaired remotely (Figure 13). Coffeemakers will download new functions as they become available. Entertainment media will download movies, games, music, and a week's worth of your favorite television programs from your cable company, satellite operator, or other video service.

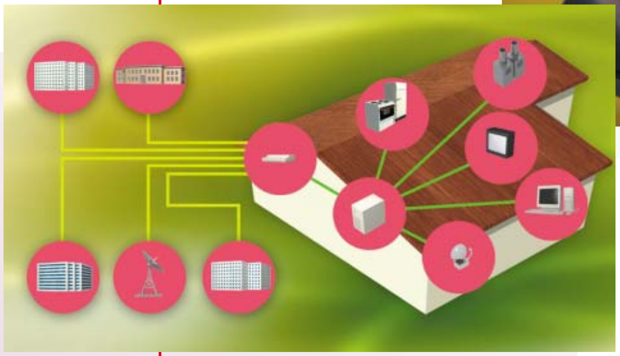
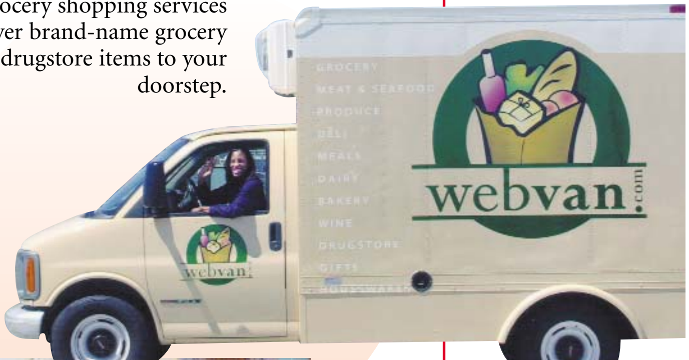


Figure 11
An integrated home network connects personal computers, security systems, heating and air conditioning, entertainment systems, lights, sprinkler systems, and smart appliances.

Figure 12
Grocery shopping services deliver brand-name grocery and drugstore items to your doorstep.



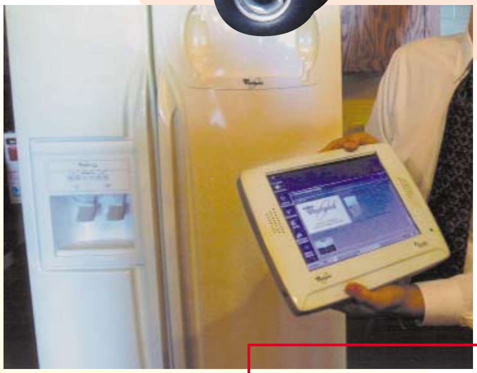


Figure 13
Smart homes feature appliances that communicate with manufacturers and let you connect to the Internet for news, recipes, and cooking information.

Communications and Networks

The methods of transmitting and sharing data are about to change dramatically. Updates include Microsoft's .NET strategy, home wireless networks, wired broadband, wireless communication, the Bluetooth™ standard, mobile Internet access, global positioning systems, electronic paper and ink, and multiple-function telephones.

.NET AND SOFTWARE SUBSCRIPTIONS Microsoft's .NET strategy is a new environment for developing and running software applications. .NET will provide instant access to data and services in the context of your current task. Microsoft plans to shift the focus of software from the desktop to Web-based services. As part of its Office Online initiative, the company has granted permission to more than 20 application service providers to host Microsoft Office applications. A .NET version of Office is slated for a 2003 release.

HOME WIRELESS NETWORKS Most technology companies are taking sides and backing one of two competing wireless standards for the home, but others are backing both. Apple Computer, Dell Computer, Sony, 3Com, and 70 other companies are supporting the Wi-Fi, or 802.11B, standard, while Intel, Motorola, Hewlett-Packard, and 80 other corporations are backing the alternate HomeRF standard. IBM and other companies are backing both, reluctant to be caught with obsolete equipment. The battle for dominance likely is to continue as new Net appliances and wireless devices emerge, data transfer rates increase, and prices drop.

WIRED BROADBAND During the next few years, home and business users can expect much faster access to the Internet as cable and telephone companies provide broader bandwidth. As discussed in Chapter 9, bandwidth is a measure of the amount of data a communications channel can transmit over a given period of time. The key to speeding up Internet access is to increase the bandwidth of the communications channel between the user and the access provider. For most users, this part of the communications channel, which is called the last mile, often involves using a modem to dial up and connect to a server over slow analog telephone lines. Several cable and telephone companies are increasing the bandwidth of the last mile by using fiber optics, broadband cable (TV cable), and fast Digital Subscriber Lines (DSL). Higher-bandwidth communications channels will eliminate the use of dial-up modem connections and greatly increase Internet access speeds for streaming video, interactivity, and real-time applications.

Figure 14
Wireless desktop connections will become commonplace in the next few years.

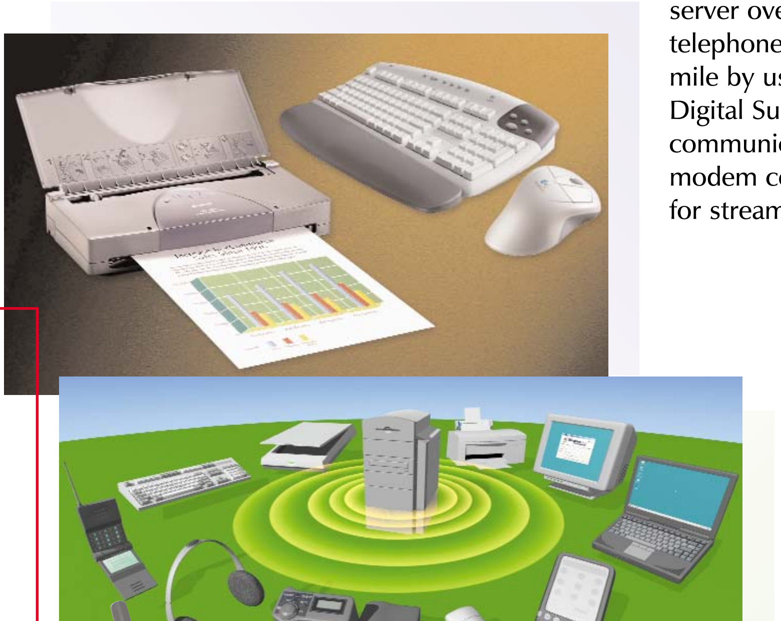


Figure 15
Wireless Internet connections will boost sales of handheld computers, particularly with expansion port add-ons such as keyboards, GPS modules, and bar code scanners.

Mobile and Wireless Connectivity

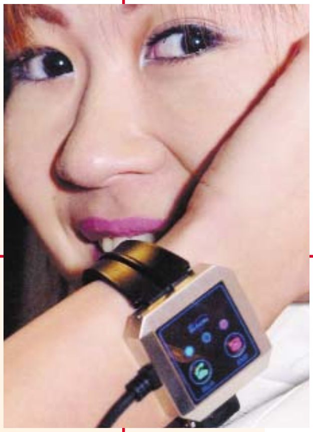
As the personal-computing market matures, consumers are looking for new ways to access the Internet and to communicate. Cordless products are in high demand, and these devices with Bluetooth™ technology should flood the market in the next few years. Third-generation communications service will increase Internet services. Other advances will be made in global positioning systems, electronic paper and ink, and multiple-function telephones.

WIRELESS DEVICES Recent advances in digital wireless technology have focused on using mobile telephones and handheld computers and devices. During the next few years, as these wireless forms of communication become the norm, attention will turn towards developing cordless computers (Figure 14) and other household appliances. Palmtops are expected to be the top-selling wireless devices (Figure 15) with an average annual growth of 28 percent through 2004. Palm, Inc., continues to dominate the wireless market, but products from Handspring and from companies using the Windows CE operating system will continue to erode Palm's market share.

BLUETOOTH™ Bluetooth™ technology allows cellular telephones, pagers, handheld computers and devices, and other wireless products to detect one another and communicate across short distances, usually a maximum of 30 feet. According to Cahners In-Stat Group, a leading industry analyst firm, manufactures should ship more than 1.4 billion Bluetooth™-enabled devices by 2005. The Bluetooth Special Interest Group (SIG) developers from the computing, networking, and telecommunications fields jointly are planning a wide range of applications, such as those that allow travelers to receive flight information automatically at airports or to be directed to the nearest coffee shop as they walk down a street. Shoppers with Bluetooth™-enabled cellular telephones could receive coupons as they walk past displays. Developers state this technology ultimately should add no more than $5 to the price of a chip.

MOBILE INTERNET ACCESS Japan's pioneer mobile-Internet company, NTT DoCoMo, Inc., plans to lead the world's new phase of broadband services, Wideband Code Division Multiple Access (W-CDMA). This third-generation (3G) mobile communications service has the data-transmission capacity to download songs and short video clips. Each day, more than 50,000 new Japanese consumers subscribe to DoCoMo's mobile Internet service, i-mode (Figure 16), which provides access to thousands of official i-mode and independent news services, information, and entertainment, as well as such specialized services as airline reservations, online shopping and banking, and the ability to exchange digital images. In contrast, American consumers have been reluctant to subscribe to mobile services that offer shopping, weather updates, and e-mail. DoCoMo has invested $9.8 billion in AT&T's wireless unit, representing a venture to close the gap between wireless technologies in the two countries.

Figure 16
NTT DoCoMo's i-mode mobile Internet service is immensely popular among Japanese consumers.



GLOBAL POSITIONING SYSTEMS The U.S. Department of Defense developed the Global Positioning System (GPS) for national security, but today this technology is found 10 times more frequently in civilian, rather than military, applications. The already widespread use of GPS devices is about to increase dramatically in 2002 when cellular telephone companies will be able to locate the position of their callers to within 100 meters and when localized wireless advertising is available. Cellular telephones may contain GPS technology that can be used on a pay-per-use basis. Designed to be implanted in the human body, the Digital Angel's wearable patch (Figure 17) will send and receive GPS information along with medical diagnostic data. In another use, a wind-up generator may provide the power for recreational GPS users who travel without power, such as hikers, bikers, and kayakers.

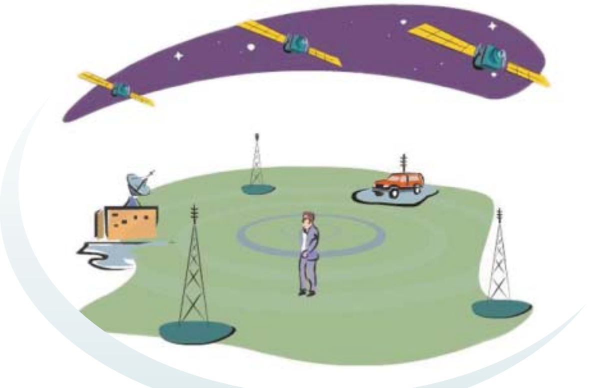
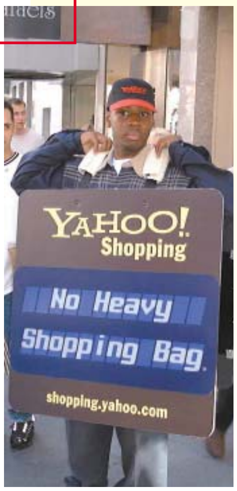


Figure 17
The Digital Angel provides location and monitoring information. Its microchip includes biosensors that measure body parameters and an antenna that communicates with GPS satellites.

ELECTRONIC PAPER/ELECTRONIC INK Engineers are developing electronic paper and ink products (Figure 18) that combine the strengths of digital technology with the qualities of paper, including its light weight and high contrast. Several companies are developing this rewriteable medium. Some use microscopic liquid particles or beads that are white on one side and black or red on the other and are suspended in a transparent plastic cavity. This display screen currently is as thick as a mouse pad, but eventually it will become as thin as four sheets of paper. The particles or beads respond to electronic impulses and move depending on the images requested. The next generation of e-paper will add organic light-emitting diodes (OLEDs) to the plastic sheets to display full color and full-motion video.

Figure 18
Electronic paper and ink products can be used for commercial displays. The messages can be changed by remote control.



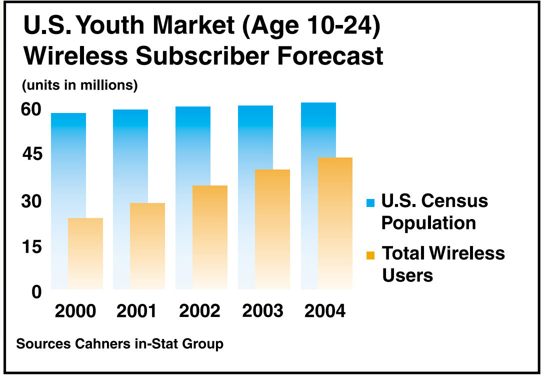


Figure 19
(Source: Cahners In-Stat Group) Cellular telephone manufacturers and carriers are aiming to lure young users to their products.

MULTIPLE-FUNCTION TELEPHONES Cellular telephones will be packed with new features. Some will be popular among young users — those between the ages of 10 and 24 — who are the target group for the newest products (Figure 19). The fastest growing cellular telephone application is e-mail messaging. Nearly every digital wireless telephone sold will feature this two-way text messaging, which allows users to type short messages into their telephones and then transmit the words to other wireless telephones. This service is very popular in Asia and Europe, especially in countries that do not have reliable or easily accessible wired telephone service. More than 10 billion text messages are sent each month. A joint venture between Ericsson and Microsoft should offer improved e-mail services on cellular telephones.

More people worldwide will be accessing the Internet via cellular telephones rather than by personal computers in 2003, according to industry executives. Fourth generation (4G) wireless standards are predicted to be in place by 2010, and they will offer even faster mobile Internet access.

Robotics

Computers capable of performing human tasks will be seen everywhere from hospitals to your home. Medical breakthroughs achieved in hospitals include brain pacemaker implants and distance surgery. Homes are becoming lively and clean with the advent of robots for entertainment and vacuuming.

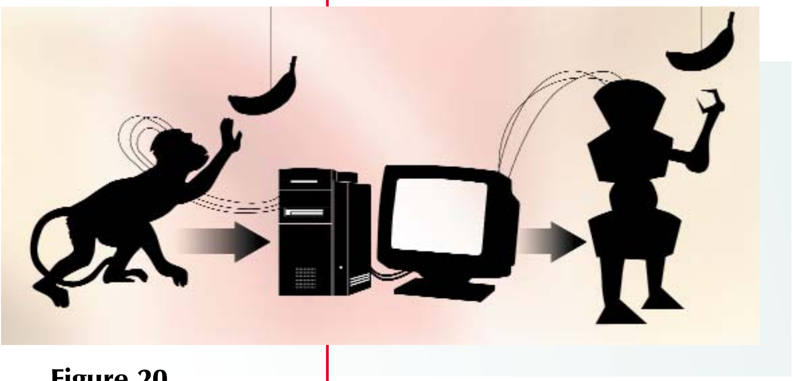


Figure 20
Research involing monkeys is helping researchers record brain cell activity. When the monkeys perform a learned task, their neurons generate brain waves that are transmitted to computers via wires implanted in the monkeys' brains. The computer decodes and sends the data to a robot that replicates the monkey's movements.

BRAIN PACEMAKER Scientists working with monkeys and studying how brain cells interact are perfecting a type of pacemaker to implant in the brain and send brain waves directly to a robot or device (Figure 20). One practical use is for reading the brain waves of people with seizure disorders, anticipating a seizure, and delivering drugs or electrical impulses that can stop or prevent a seizure.

DISTANCE SURGERY The next generation of health care will promote the use of robots to perform surgeries (Figure 21). The robots' precise skills and small sizes — less than one-fifth the size of traditional instruments — make surgeries less invasive and recovery times less prolonged. Surgeons view three-dimensional images of internal organs on large monitors and can control the robots' actions through voice commands.

Operating rooms will undergo another dramatic change when surgeons practice telemedicine. Through the use of videoconferencing and satellites, doctors can perform surgery when they are in locations other than the operating room.

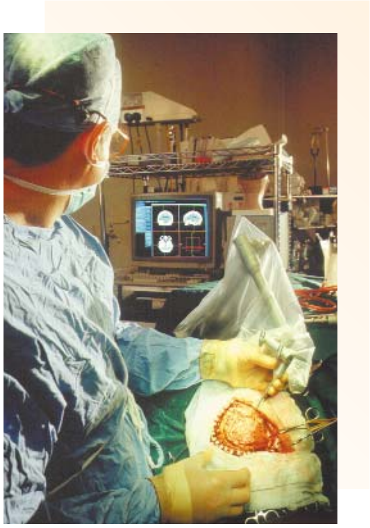


Figure 21
Robot-aided surgeries help surgeons remove brain tumors. Information regarding the precise location of the tumor displays on the monitor and is fed into the robot's computer. Robotic surgeries result in minimal damage to the surrounding brain tissue.

AIBO Now you can have mankind's best friend without the mess and expensive veterinarian bills. Sony Corporation's AIBO (Artificial Intelligence Robot), which coincidentally is the Japanese word for companion, is a breed of entertainment robot with voice recognition technology, emotions, instincts, the ability to learn 50 verbal commands, and four senses for touch, hearing, sight, and balance (Figure 22). AIBO is part of Sony's development efforts to create robots that coexist with people and create unlimited opportunities for humans to interact with computers.

CYE-SR You will not have to worry about AIBO shedding its fur around your house, but this problem is a given with a real dog. Why not let a robot clean your room? Just use your personal computer to program the Cye-SR robot that is attached to the Probotics cordless vacuum cleaner (Figure 23). Cye-SR will travel throughout your house in search of dust and dirt.

Figure 22
Each AIBO develops an individual personality based on its interaction with its environment.

THE FUTURE OF INFORMATION SYSTEMS IN BUSINESS

Although millions of homes now include one or more computers, businesses by far are the largest users of computers. Around the world, organizations install and use millions of computers of all types — mainframes, personal computers, and more — for applications such as inventory control, billing, and accounting. These computers often are part of a large information system that includes data, people, procedures, hardware, and software.

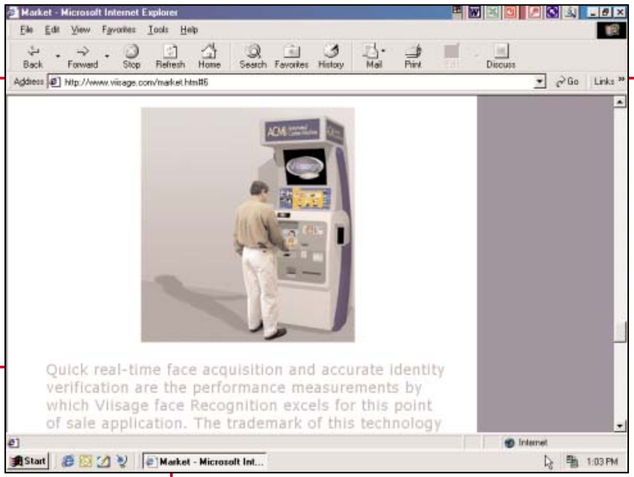
Existing business information systems will undergo profound changes as a result of the computer trends just described. As computers become increasingly ubiquitous and technologies converge, businesses will rely on computers for communications — and users at all levels will need to be computer literate. These new technologies will enhance security measures, provide computers for all employees, improve communications and health care in hospitals, and shape t-commerce and e-business.

Figure 23
The Probotics cordless vacuum cleaner comes with an added feature — the Cye-SR robot that scouts out dust.

AUTHENTICATION/SECURITY Public surveillance by businesses, government, and institutions is a growing industry, spurred by smaller and less expensive technology. According to the Security Industry Association, nearly $2 billion has been spent on computer controlled closed-circuit television networks, such as those being used in more than 60 U.S. cities to curb vandalism, prevent crime, and record incidents.

Surveillance is being taken to a higher level with software that converts images of faces to a series of 14 reference points, such as the eyebrows' bone structure and the distance between the eyes. This data is stored in databases and compared at rates of 45 million records per minute to people who pass by security cameras at countries' border crossings and who apply for new driver's licenses.

Upcoming software can be trained to recognize threatening behavior, such as when someone points a gun, and then alert the police. Applications also could help maintain security at automatic teller machines, where cardholders' facial images could be stored in a database and compared to a person using the machine (Figure 24). Computers also will use video cameras to record and identify individuals


Market - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Forward Stop Refresh Home Search Favorites History Mail Print Discuss
Address http://www.viisage.com/market.htm#6
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Quick real-time face acquisition and accurate identity verification are the performance measurements by which Viisage face Recognition excels for this point of sale application. The trademark of this technology

Figure 24
Instead of entering a PIN, automatic teller machine users can access their accounts securely using face recognition to verify their identities.

through facial expressions and fingerprint recognition (Figure 25). Industry experts project that surveillance cameras could become so prevalent that everyone could watch everyone at any time.

WIRING THE ENTIRE WORKFORCE For many years, computer use centered around white-collar professionals sitting at desks using wired computers. Indeed, of all employees, nearly 70 percent uses some type of computer during the workday. With the influx of wireless products, manufacturers are striving to wire the other 30 percent of workers holding mobile positions, such as mechanics, inspectors, messengers, and warehouse workers, so they can send and retrieve detailed information while keeping their hands free for other tasks. The Palm OS® and Windows® CE platforms are opening opportunities for the blue-collar world, as are hardware and software advances in speech recognition, wireless headsets, and wearable computers equipped with processing power equal to that of desktop computers.

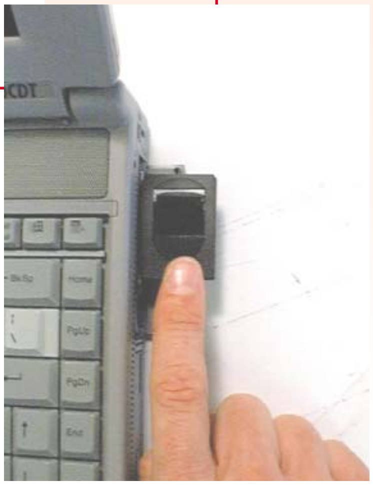
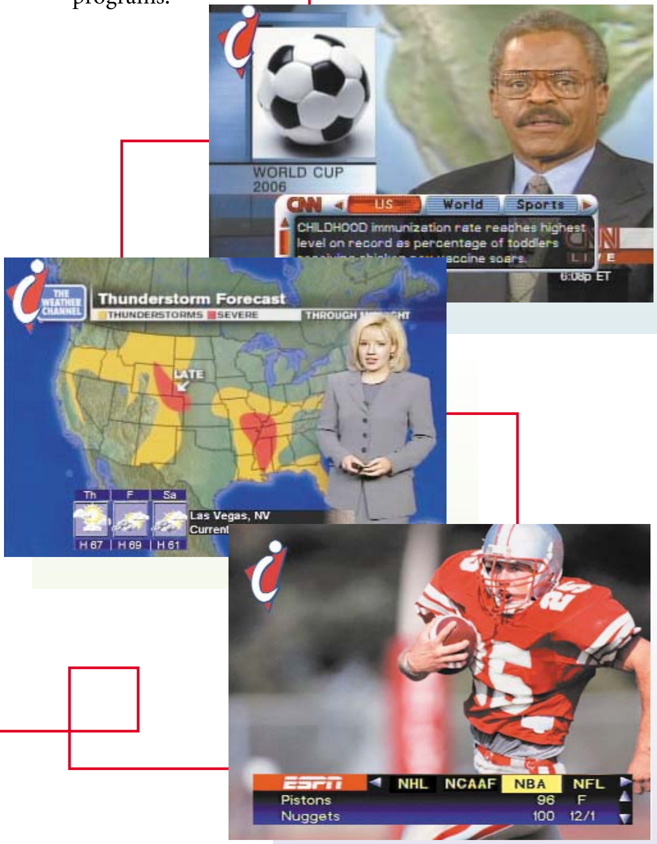


Figure 25
A fingerprint reader captures the curves and indentations of a fingerprint.

HEALTH-CARE INDUSTRY The medical industry has been recognized, in general, as being one of the last fields to integrate the Internet and high-tech solutions. Recent cuts in insurance reimbursements and federal Medicare spending have decreased revenues, resulting in budget cutting measures. Many health facilities, however, are integrating online medical-records systems, electronic medical charts, and medical literature searches. Wireless products will help improve patient care and communications; for example, some emergency room personnel use Palm handheld computers to access patients' medical records.

T-COMMERCE Television advertising is taking a new turn with the advent of t-commerce. Instead of buying commercial time, advertisers embed their ads in actual television programs (Figure 26). Viewers use their remote controls to interact with the television programs and advertisements by replying to free offers, buying items, receiving sports scores, and participating in games. The Wink service is featured on CNN, The Weather Channel, ESPN, and "The Tonight Show with Jay Leno." This form of advertisement can be termed merchantainment – a combination of merchandising and entertainment.

Figure 26
Wink Communications uses t-commerce in a variety of television programs.



E-BUSINESS The volatile e-commerce marketplace has produced some winners and many losers. In 2000, more than one dot-com (Internet-only) company failed each day. Companies with greater successes were those with both Internet and physical presences, known as clicks-and-mortar businesses. Each year, individual and business consumers purchase more goods and services online; approximately 50 percent of Web users shop online, and the same percent of investors trade securities online. During the next few years, more e-commerce applications — and the technologies used to support them — will be developed. Many of these technologies will be focused on improving the security of and expediting credit card transactions.

FEATURE SUMMARY

Despite the surge in dot-com failures and employee layoffs in early 2001, the demand for high-tech workers continues to be extremely strong. According to the U.S. Department of Labor, more than 5.6 million new software engineers, Web programmers, optical networking specialists, programmers, and systems analysts will be needed by 2006. Indeed, amazing opportunities increase daily in the ubiquitous computer technology industry.